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PRELIMINARY REPORT

OF THE

STATE GEOLOGIST

TO THE

LEGISLATIVE ASSEMBLY.

EIGHTH REGULAR SESSION--1874.

1859

SALEM, OREGON:
MART. V. BROWN, STATE PRINTER.
1874.

PRELIMINARY GEOLOGICAL REPORT--1874.

To His Excellency,
L. F. Grover,
Governor of the State of Oregon:

Dear Sir: In obedience to the requirement of the Act of the Legislative Assembly of Oregon, to which I owe the office of State Geologist, I have the honor to submit to you the following preliminary report:

The Act I find as follows:

"Be it enacted by the Legislative Assembly of the State of Oregon:

"*Section 1st.* That Rev. Thomas Condon is hereby appointed State Geologist. He shall hold his office for the term of two years, and until his successor is duly appointed and qualified; *provided*, that in case of vacancy in said office at any time, either by death or resignation, the Governor is hereby authorized to fill said vacancy.

"*Section 2nd.* It shall be the duty of the State Geologist to make geological examination of differents parts of the State from time to time. He shall make biennial reports to the Governor of the results of his explorations and surveys, accompanied with such maps and drawings as may be necessary and proper, to exemplify and elucidate the same.

"*Section 3d.* The compensation of said State Geologist shall be one thousand dollars per annum, payable quarterly, in gold coin; and the Secretary of State is hereby authorized and directed to draw his warrant for such compensation upon any funds in the treasury not otherwise appropriated.

"*Section 4th.* Inasmuch as there is urgent necessity for the immediate appointment of such officer this Act shall take effect and be in force from and after its approval by the Governor."

Approved October 24, 1872.

The work, to which this Act called me, seemed then what it has since proved in practice, a difficult task. It at least seemed to require that the State Geologist attempt to earn one-half the salary necessary to support his family, by traveling in the mountains, and the other half by staying at home.

The smallness of the appropriation made indicated, and definite information furnished by the movers of the bill corroborated the view, that it was intended rather to aid me in work in which I was known to have been engaged for years, than to ask for any new researches.

There were then extensive regions of the State I had never seen, the barest outline of whose geological features I could not give; mines and mining regions I had not visited, and of whose working I could therefore not report; vast bodies of coal and iron, whose localities and geological surroundings I was incapable of giving; collections of fossils, kindred in many things to ours, in a neighboring State, with which I ought to have been able to compare our own; of whose aid I must remain deprived.

Yet, some few things seemed plainly within my reach. I had, for years, been gathering facts from sections of Oregon I had visited and examined; these lay crudely in my mind, and needed bringing into systematic agreement with the latest researches of the times. This I could attempt

There had, too, accumulated on my shelves, a large collection of Oregon fossil specimens, very many of which were new to science, and important in their bearing on some of the most interesting problems of human thought.

The record of geological history these fossils were capable of opening to the public mind seemed to me so important that the world had a right to expect it, of the State of Oregon, that descriptions of them be suitably published, illustrated by good engravings or photographs.

The best stimulus might be hoped for from this to our own schools and colleges — our own young people would have their interest in scientific studies greatly quickened, if added motives were needed to urge to so manifest a public service.

Descriptions of these fossils, with suitable illustrations, of engravings or photographs, ought then, it seemed to me, be published without delay; but this could not be done properly till their true relation to science be determined. Here then was work that might be attempted.

These facts practically defined the work within my reach, and, furthermore, may now explain why, in this report, so little is said of mines and mining industry, while so large a share of attention is drawn to the subjects of general geology, and palæontology. But, besides this, I had another reason for omitting, for the present, all attempts to offer a report on our mining industry. The General Government published, only four years ago, a very full and very carefully prepared report of "Mining Statistics West of the Rocky Mountains," by Commissioner Raymond. (See Report of Mining Statistics, 1870.) This has given the mining industry of Oregon a wide publication, and a full and favorable report.

On the other hand, Oregon's wonderful contribution to geological history has never yet been suitably, or adequately published.

Permit me to prepare the way for what I have to say on the geology of Oregon by a brief outline of

RELATED GEOGRAPHICAL FACTS.

Oregon, as we approach it from the sea, seems literally rock bound. So continuous is the line of mountains along the coast, so short and narrow the four or five inlet openings by which it is pierced, that the mountain range defines the coast.

On reaching the Columbia river, however, an estuary of six or seven miles in width, opens a fine view of the interior, showing the snow capped peaks of the Cascade Mountains in the distance.

As one enters the Columbia and advances up the river, the passage through the mountain barrier is scarcely perceived, so scattered here are its ridges, and so wide the passage the river has worn through them. Farther inland we reach the mouth of the Willamette, and find the confusion of a broken country slowly giving way to a well defined arrangement of hills and mountains into two great groups extending north and south, parallel with each other and the coast, about seventy miles apart.

The outer group, that of the Coast Range of Mountains whose lines we have just passed, indicating, even in the lesser altitude it reaches, its comparatively younger record and subordinate position. The inner and greater group, that of the Cascade Range, rising to the height of six to eight thousand feet above the sea, and at almost regular intervals surmounted by snow-capped peaks, rising to nearly double that altitude, like watch-towers upon a wall.

From among these elevated watch-towers of the mountains, let us choose one from whose summit we may get an outlook over the land, that we may take in its frame work. Either Mt. Hood or Mt. Jefferson will answer our purpose.

Now if from our elevated place of outlook we turn to the west, there, about seventy miles distant, we shall see the irregular summit line of the Coast Range of Mountains, with here and there a glimpse of the ocean beyond. This distant summit line, and much of the broad base on which it rests, are covered with a dense growth of evergreen timber, giving them at all seasons a blue color, the distance alone varying the tint.

This will be the distant background. The nearer middle ground of the view will appear in great patches of grey and drab, interlaced with belts of blue and green, extending from the line of the Columbia River on our right, to the foothills of the Calipooia Mountains, on our left, nearly one hundred and fifty miles, with an irregular, winding line of blueish green through its whole length, that marks the course of the Willamette River. These stretches of grey and drab mark the prairie regions; the streaks and patches of blue and green are belts of timber that run down from the foothills or mark the course of some meandering stream in its passage from the mountains, on either side of the valley, toward the great central line of drainage.

It is instructive to consider how many of the greater human interests are suggested by something of either want or supply, in such a view as this.

For the lover of that which is great and beautiful in landscape, here is certainly a wealth of mental food. To the thought of the mechanic and artisan, that vast area of distant blue is not a mere patch of landscape coloring. His thought instantly analyzes it into millions of tall, graceful timbers, awaiting the hand of industry, and the application of capital, to appear in the marts of commerce, as the long, graceful spars of naval architecture, the massive beams for bridges, and building frames; for which, and a thousand kindred purposes, calling for the greatest length and strength to a given weight, Oregon's red and yellow fir (*Abies Douglassn,*) are unrivalled. He has heard too, rumors of coal and iron, found in outcroppings of those foothills. He knows the meaning of such signs, and their bearing on the future of any people.

To the agriculturist, also, this grand outlook of wood and prairie has its voice of promise.

He knows that nearly 8,000 square miles of land stand surveyed in that Willamette Valley alone, an area greater than that of the State of Massachusetts; and that a very large part of that surveyed portion is already acknowledged to be one of the great wheat fields of the world.

To the geologist, that mountain range set against the western horizon, is a belt of sea beach elevated into land. Here and there he sees it interrupted, or to a limited extent covered by outflows of trap—otherwise he finds it to be made of the mud banks of an ancient sea, hardened into rock. The whole range, from Astoria to Port Orford, abounds in the evidences of this.

Sea shells filled with spar or chalcedony, crusteacean, and fish skeletons, lie enclosed in its rocky ledges, telling plainly of other conditions, and other times.

To the geologist too, the broad stretch of drab colored middleground of the picture tells its story. He sees in it the almost unchanged bed of a more recent inland sea, whose very sediment of blue clay underlies the farms of to-day, occasionally revealing, where excavated, well preserved remains of the elephant and the mastodon, the horse and ox, that made part of the pre-historic life of its shores.

Clear and distinct are the traces of these great changes over that landscape; the more ancient records graven in tablets of stone, the more recent in equally legible letters, though written in sand and clay.

The view we have been describing, so suggestive of widely varying interests, so full of prophesy of future wealth and enterprise is that of

WESTERN OREGON.

Let us not forget that other things are visible to o elevated outlook. How earnestly one's eye takes him that grand view towards the south, for our very stan point is in the meridian of its wonders.

The Three Sisters, Mt. Jefferson and several small peaks to the south, and if we look northward, Mt. A Mt. St. Helens and Mt. Ranier a peerless line of mo peaks, all in sight, and almost in line, at least in th of the grand mountain range they so nobly crown. ifestly, the Cascade Range, on which we are standing, geographically, as well as geologically, the key to Oreg whole frame work.

Let us look to the eastward. At about the s distance eastward that the Coast Range is west of stand-point we may see distinctly another rang mountains, that of the Blue Mountains—covered like Coast Range, to the summit, with evergreen timber. in our western view so here, between our elev observatory and that distant back-ground, there is a b irregular space of drab colored surface that cates the grass covered plains of the interio more broken surface and irregular outline than th space of the Willamette Valley and far more exte

These more prominent and distinct portions of that eastern back-ground are not like the western one in well defined position across our line of vision; they are rather the nearer spurs of receding lines of timbered ridges with great bays of lower country between them. These deep bays are indicated in our landscape by those distant faint strips of drab colored surface among the blue spurs.

In these bays, among those Blue Mountain spurs, some of the most wonderful geological records of the continent are legibly written. One group of facts strewn with lavish, even wasteful profusion, upon elevated terraces of these mountain spurs, tells of times when the ocean was there too. Another group, telling in equally legible record, of a later period, in which the ocean waters were no longer there, but in their place a wide extent of fresh landlocked waters. Another, telling of a still later period, in which narrower, though yet deep lake depressions, surrounded by wooded slopes, gave character to the landscape. These were the days of the fullness of animal life in Central Oregon. The country abounded in these lakes, their shores were covered with a rich and varied flora, in strange contrast to its appearance to-day. The famous bunch-grass, its only covering now, makes it eminently a region of flocks and herds. Its climate is a fine one, the soil is abundant, uniform in quality, and well distributed, even to the hill-tops. Its one drawback is, that it is not a country of Summer showers.

More than out of sight from even the elevated spot chosen for our geographical outlook, among the central ridges or along the southern, southeastern, eastern and northeastern declivities of these mountains lies one of Oregon's gold fields.

From one town of that region, Canyon City, ten years ago, there was shipped an average of $20,000 worth of gold dust a week. There is still a good deal of gold dug there. Baker City, east of the mountains, is still the centre of important mining interests.

This whole field of Eastern Oregon has been but partially examined for it is only within five or six years that prospecting here has been safe. Parties compelled to examine a country in the face of powerful hostile Indians, such as the Snakes have always been, did the work at great risk and large expense. A day is doubtless near when all its resources will be better understood.

If now we turn toward the southwest the eye will rest, in the distant back-ground, upon the elevated ridge of the Callapooya, beyond that horizon and westward, even to the beach sands of the ocean is another gold field, one that in past years was productive, and may at any time rise to importance again, with the introduction of improved processes for working, for the gold is confessedly there.

This cursory outline of related geograpical facts seemed needed, as an introduction to the different groups of geological facts which follow.

By way of indicating the sources of evidence upon which Oregon's geological records rest, I hereby submit two brief papers:

One on the testimony as drawn from our mountain ranges.

The other on the testimony as drawn from old lake depressions.

First, then—

TESTIMONY OF OUR MOUNTAIN RANGES.

The Cascade Range.

Where the Columbia river has cut its way through the

Cascade Mountains, the work of the great torrent is so complete, that while the ocean tides are often perceived at the lower landing of the Cascades, there are but 27 feet of fall between this and the lake-like level above which continues unbroken to the Dalles, forty-five or fifty miles. At this lower landing, and directly in the axial line of the Cascade Range, there is a fine exposure of fossil wood and leaves in large botanical variety, and in a fine state of preservation.

Large trees protrude from beds of sandstone and conglomerate, and the leaves of forest trees are finely preserved in the finer layers.

In places where the current has undermined these fossil beds, one may stand under the spread roots of large stumps of trees, evidently standing where they grew. All these are changed to stone—the wood is generally silicified, occasionally changed to coal, but so little altered that the distinctive character of the wood is often plainly visible.

The relation of these beds of sandstone and conglomerate to the 4,000 feet of mountain mass overlying them, may be seen by examination of the lateral ravines of small streams close by. In these the fossil beds are seen extending back till their dip is lost to the eye, but sufficient to prove that they underlie the mass of the mountain, and could not have been a trough deposit in the river bed.

From this it would seem plain that these beds of fossil wood, hold the true record of the age of the Cascade Mountains. They are down at the water's edge, they are in the axial line of the range, they underly the mass of the mountain. The summit overlying this fossil bed measures 2,700 feet from the water. On the other side of the river, the summit is farther back, yet a better indication of the former level of the whole, which is now here

4,500 feet above the water. Here then we have an exposure of successive outflows of eruptive rock, over 4,000 feet in vertical thickness, overlying a bed of well preserved fossils.

Of these eruptive rocks the porphyries were poured out first. Some fine exposures may be seen along the side canyons above alluded to; and the enclosed boulders of the fossil beds are chiefly from these older porphyritic rocks. Trachyte is higher in the series, and may be seen underlying the basalt in the face of the mountain north of the river—dense, dark basalt crowns the whole.

One is struck with the evidence of the great length of time covered by these changes, as indicated by the old look of the eroded surfaces of the underlying strata, where their lines of contact are seen.

It is so with the sandstone and conglomerate at the water's edge. They were evidently deeply eroded into a varied surface, when overflowed by these floods of later lavas. So, too, of the porphyries, and in a still more distinctly visible form, the grey trachytes of the north mountain, are seen to have been worn into hills, with deep intervening cañons, before that overlying dark massive basalt covered up all inequalities and formed a new horizontal surface 4,000 feet above yonder fossil bed.

The characteristic tendency of basalt to vertical fracture, especially as in this case when overlying a softer rock, renders the portions of these mountains that overhang the river bank, liable to a good deal of crumbling. That this friability is deep, and not a mere surface movement of debris, is proved by a general but slow movement of both banks towards the river. I have the information from Mr. John Brazee, the able engineer of the O. S. N. Co., that this slow, glacier-like movement of the mountain points toward the river, is such as to necessitate frequent re-adjustments of the railroad lines of the Company on both sides of the river.

One readily sees how this pressure of foothills towards the bank, may be unequally resisted, or accelerated, by the rate of erosion over the river bed, or the setting of the current towards one bank rather than to the other.

One sees, too, how any violent disturbance, such as that of an earthquake, would greatly increase this streamward movement, even to the extent of obstructing the channel, and retarding the current, so as to cause the river above the Cascades to rise above its former level. That something has occurred here, to raise the Columbia River above the Cascades, within a century, or so, is almost certain; for submerged groves of trees, occur along both sides of the river, above, for a distance of 12 to 15 miles. These submerged forest trees are not petrified, as sometimes stated, but trees in slow process of decay, in positions to which land slides could not have brought them, and in a depth of water in which they could not grow. They are now, in the lowest stages of water, standing in a depth of 15 to 20 feet.

It is, therefore, almost certain that when these groves of trees were living the Columbia river, between the Upper Cascades and the Dalles, was more than twenty feet lower than it is now. How was it raised to its present level?

A violent earthquake, within a century or so, might have caused the change by greatly and suddenly increasing what is now continually going on, at a slower rate, the settling toward the river, from both sides of the mountain masses of both banks. This would, until the river had time to so reexcavate to its former width, the whole of the obstructing mass raise the river above the Cascades. Several separate lines of evidence unite to render it probable that such a thing did occur here whatever the measure of its results.

There is an Indian tradition to the effect that, many years ago, Mt. Hood and Mt. St. Helens had a quarrel during which these mountains threw out fire and smoke and hurled great rocks at each other; that such was the violence of the contest that the ground shook for miles around, and in this commotion a bridge that had long existed at the Cascades was broken down; that the ruin of this bridge so obstructed the river as to dam up the water above, and so far as to change the height of the falls beyond The Dalles, sufficient to enable the salmon to pass those falls, which they have continued to do ever since, but which was never before known to occur. They add that whereas the Indians of the upper country, before that great event, always came to The Dalles to exchange buffalo robes for salmon, that since then that trade has never been resumed.

The fact of the slow movement referred to being so well established, and the added fact of the submerged forest, unite in suggesting that there may underly this exaggerating tradition a rude record of a fact sufficient at least to account for the submerged forest.

THE TESTIMONY AS DRAWN FROM THE OLD LAKE DEPRESSIONS OF THE INTERIOR.

The recognition of numerous extensive old sea beaches throughout the interior, and especially along the slopes of the Blue Mountains, carries the mind back to the time when nearly all that is now known as Oregon, was covered by the Pacific Ocean. That it was so as late as the close of the cretaceous period, is proved by the presence of cretaceous marine shells, in elevated places throughout the interior. That fossiliferous limestones and slates of an older period are found in the Blue Mountains, uncovered by any later deposits, while belts of cretaceous and tertiary rocks lie in an apparent shore line around them, would seem to indicate that most of what is now known as the Blue Mountain region, must long have existed above the waters, as an Island, while the real shore line of the continent ranged far to the eastward

Still later, a low line of islands must have appeared to the westward, along the present line of the Cascade Mountains. As this new barrier to the sea became a continuous belt of land, that portion of the waters which it separated from the rest, became an inland sea, enclosing still, as an island, the whole Blue Mountain region.

Once separated from the ocean, these landlocked waters must have received the streams from the main land. This, while the salt water from the ocean was shut off, must have slowly changed those great bodies of inland waters from salt, though brackish, to fresh water.

Another, and a later one of these upfolds of the sea bed, must have occurred still further to the westward. It is now what is known as the Coast Range of Mountains, in Oregon; the Olympic Range of Washington Territory; farther north, it exists now as a range of islands from Vancouver to Sitka.

Measured by its general results, this latest upfold must be regarded as a feebler application of the same force that raised, *first*, that upon which the Rocky Mountains were built, and *second*, that on which the Cascade Mountains were elevated, now applied to a *third* belt, this one of the Coast Mountains.

The trough, too, which it enclosed between these Coast

Mountains and the Cascades, possessed general characters like those formed farther east.

But this one had noticeable special features. It was narrower. It evidently retained, for a longer time, its connection with the ocean. Its northern dip is such, that north of Vancouver Island, this ocean connection is still kept up through a multitude of straits.

Three great stages of the progressive elevation of these successive belts of old sea bed into land, and of the drainage of the intervening troughs, are doubtless now presented in the respective conditions of the Willamette Valley, Puget Sound, and Queen Charlotte's Sound; although these, in their present condition, are perhaps less stages of progress than exhibitions of the results of different degrees of force, which is now plainly seen to have been greater over against the wider part of the ocean, and feebler opposite the narrower to the north. The Oregon portion of the trough is

The Willamette Valley.

But let us return to the interior. As already stated, the great depressions of this newly added portion of the continent remained covered with water, till by the continued results of increased elevation, the deeper erosion of the drainage of outlet-streams, the large amount of sediment washed into them, and the drying off by evaporation of those that were unsupplied by streams from the mountains, the greater part of them became drained into dry land.

Many of the deeper ones still continued receiving the streams from the mountains, and becoming permanent lakes. How many, and how extensive these were, remains yet to be ascertained. Only occasional glimpses of a few of their remains can be had, and these only in places where streams have exposed them by washing the later coverings of rock by which they were concealed.

That they extend far under existing lava beds is certain, and were numerous enough to make the Oregon of the Middle or Miocene Tertiary period, a beautiful country, is equally so.

It many places it seems to have occurred that depressions, such as lake beds, and river valleys, were during the later Tertiary times, filled with lava, which became so much harder than the hills that made its mould, that subsequent wearings of time eroded these surroundings, leaving the once depressed lavas to form the present mountain ridges, 1,500 to 2,000 feet above the valleys.

The neighboring declivities of the Blue Mountains, became in early Tertiary times, a favored region. It was surrounded by these inland waters. The fossil foliage and other remains of those times indicate great floral beauty, and variety in the vegetable world; and later, an equally great variety of animal life, in its higher forms.

Death, then as now, would come, and as floods would occasionally overflow stream banks, whatever of animal or vegetable remains lay strewn there would often get washed down into the lake, and covered there among its sediments. Occasionally, too, a whole carcass would wash there, and after floating awhile would lose its flesh, and one by one, its bones get buried deep in the soft ooze of the lake bed; the bones to be laid away, perfectly preserved, as part of the records of the times.

If now to this we add the probability that this lake depression continued to be such throughout the whole Tertiary Age, and that the whole lake bed, bones, leaf impressions, sediments and all were by some natural process changed into stone, we shall have in theory just what the John Day and Crooked river valleys now present as facts. As if to make the agreement still more full, we further suppose those lake beds afterwards drained off and left with only the ravines of the streams running along their centre lines, and lateral streams, from each side, running into their central lines of drainage, wearing in their course broad ravines, through the old lake sediments, then will our theory of the Tertiary Age be changed into a landscape of to-day.

The one of these lake depressions that occupied what is now the John Day Valley was, even as late as the Middle Tertiary period, 1,500 to 2,000 feet in depth. It retained this depth for a long time and only lost it through the combined results of gradual wearing down of the bed of its outlet stream and the equally slow elevation of the lake bed itself through the deposition of sediment.

But the fact of deepest interest to us is that during this whole time it continued to receive into its waters, and through them into its sediments, the remains of forest and field, burying them up safely in its profoundest depths, and thus securing them from decay. The perfection of this mode of preservation is well nigh complete. The minutest vein work of the leaf, the insect that fastened to its surface, the seed pod or capsule of the plant, the pores of the wood, the sutures of the animal skull, the epiphesis of the bones, enabling one to tell at a glance whether those belonged to the young or to the old; the minutest lines of age or of accident on a tooth—all preserved with marvelous faithfulness to the life-type of the period—so that no family of plants or of animals are likely to have lived on the borders of that lake during that long stretch of time, covering hundreds of thousands of years, without sharing in the record of its fossil history.

It is from such archives that materials have been collected for a geological record of Oregon's past.

SPECIAL GEOLOGICAL VALUE OF THE FOSSILS OF THE COLUMBIA BASIN.

That which now constitutes the water-shed of the Columbia river has gone through a long progressive series of changes.

In its earlier stages, what is now the river was only a chain of connecting links between extensive lakes that covered the interior.

As the elevation of these above the sea increased, the outlet drainage would also slowly increase, until what was in the earlier period a simple outlet, extended itself upward through the portion of the lake-bed laid dry. Two results would follow: *First*, The slow development of an extensive river system; and, *Second*, The equally slow laying bare of a vast extent of old lake-bed surface.

But, as we have seen, those old lake-beds were more or less filled with sediments, and these sediments generally contained the buried remains of the life of the period both vegetable and animal.

This system of lakes was continued here far beyond the natural operation of these causes alone, for three mountain chains were successively elevated, in such relation to this whole system of drainage, as to make so many great dams across it until worn through again. The Blue Mountains, the Cascade Mountains, and the Coast Mountains, were so made to vary the number, extent and depth of these waters they separated.

But further. The Columbia river began to develop itself from these lake outlets and drained lake-beds almost at the beginning of the period of mammalian life in the world and has never since been without a lake—very many of its earliest ones continuing such until recent times.

It is indeed very doubtful whether anywhere else on the American continent the agencies of lakes, rivers and mountain chains have, to anything like an equal extent, combined to record and preserve the history of the past. When one considers the interesting geological period to which the facts relate, the length of time over which their record stretches, the varied condition of life it reveals, or the number of scientific questions needing the information it gives, one has no hesitancy in urging the duty of the State to authorize the collection and publication of, at least, that which is already ascertained.

Should the Legislature deem it best to publish, suitably, these facts to the world it may be stated that enough materials are already collected to make one volume of Geological Reports a valuable work. It might contain:

First, A section on General Geology of Oregon.

Second, A section on Ancient Life in Oregon.

Third, A section on Minerals of Oregon.

The section on General Geology would be accompanied by a suitable geological map, colored to show the distribution of the rocks of the several geological periods, with such diagrams as might explain special features or facts needing such mode of explanation.

The section on Ancient Life would be accompanied by engravings of heads, bones or teeth of the animals described. This feature would be of great value, for these fossils are very strange and very beautiful. This section would contain a historical portion of wide interest to the world.

The section on Minerals of Oregon would attempt a description of our gold, silver, copper, lead, and such other minerals as may call for notice; with special attention to coal and iron, and an added chapter on those rocks that have an economical value, such as lime, marble, and other building stone, with their distribution.

Very respectfully,
Your humble servant,
THOMAS CONDON.